TRAMEX

user guide

RWS

roof and wall scanner

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INTRODUCTION

To get maximum benefit from your Tramex RWS - Roof and Wall Scanner, it is suggested that before undertaking a moisture survey, you read this manual to familiarize yourself with the operation, features and capabilities of this multi-mode non-destructive moisture detection and scanning instrument.

TRAMEX RWS AND THE BUILDING ENVELOPE

The building envelope is the physical separator between the interior of a building and the external environment in which it is located. It consists of the roof, walls and floor of a structure. It should be noted that the entire roof (external covering or protective layer to finish on ceiling), walls (external finish to internal finish), floor (sub-floor to floor finish) and windows are considered to be part of the building envelope. These are the elements that form the boundary between the interior of the building and the external environment. The building envelope can be considered as a filter between the internal and external environments. The design of the building envelope greatly influences the energy performance of a building. Moisture in elements of the building envelope can significantly affect the performance of the building envelope and have other serious consequences such as damage to materials and deterioration of air quality. Tramex manufacture a complete range of instruments for the detection and measurement of moisture in the building envelope. For roofing, walls and many types of floor construction the Tramex Roof and Wall Scanner (RWS) is the complete instrument. As originally developed the RWS is a hand-held, non-destructive, electronic moisture meter specifically for non-destructive moisture evaluation and surveying of built-up or single-ply roofing and EIFS (Exterior Insulation and Finishing System).

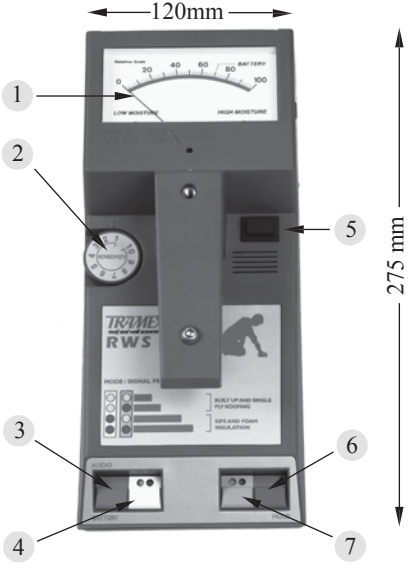
However its use by many professionals over the years has demonstrated that it goes far beyond these applications and extends to all aspects of the building envelope.

The Tramex RWS is an effective Leak Seeker and Moisture Scanner with 2 operating modes, with each mode having 2 ranges of sensitivity. This affords the user the opportunity to scan roofing, walls and the building envelope for excess moisture. The less sensitive yellow mode is designated for built-up and single-ply roofing with the more sensitive red mode for EIFS and foam installation. With the large variety of constructions that exist these designations are not always rigid and can vary significantly e.g. the more sensitive mode can be used on foamed-over roofing systems.

For those familiar with Tramex moisture meters, the RWS incorporates two of the well-known moisture scanners from Tramex, with additional features and benefits, in one instrument. These are the Leak Seeker, launched in 1983, for the tracing of leaks and detection of moisture in roofing systems and the Wet Wall Detector (WWD), launched in 1995, for the detection of moisture in EIFS.

OPERATING INSTRUCTIONS

A diagram of the instrument face with brief notes on the push button controls is shown below:



1 = Moving coil meter.
2 = Sensitivity Knob
3 = Battery check / Audio ON/OFF
4 = Mode Selector
5 = ON/OFF Switch
6 = Hold Switch
7 = Signal Penetration Selector

MODES OF OPERATION

The RWS (Roof and Wall Moisture Scanner) has two operating modes, each with two ranges of signal penetration. The mode and signal penetration are indicated by the white and orange boxes on the decal of the RWS instrument.

- EIFS Mode (Red LED selected on White switch.) is for moisture scanning of Exterior Insulation and Finishing System (EIFS) and similar type of construction cladding as well as polyurethane and polystyrene foam insulation and other types of low-density insulation systems applied to the building envelope.

- Roof Mode (Yellow LED selected on White switch) is for moisture scanning and leak tracing of built-up and single ply roofing systems.

Each of these measurement modes incorporates two sensitivities, which are activated by pressing the Orange switch: Yellow LED for lower sensitivity and lower penetration. Red LED for higher sensitivity and deeper penetration.

Audio can be turned ON/OFF by pressing Audio twice in quick succession.

HOW IT WORKS

The RWS is an electronic instrument powered by one 9volt PP3 or similar battery. It operates on the principal of electrical impedance measurement. This means that a harmless, low frequency, non-destructive signal is sent from the two rubber coated electrodes at the base of the instrument through the surface of the material being tested, deep into this material. See Figure 2.

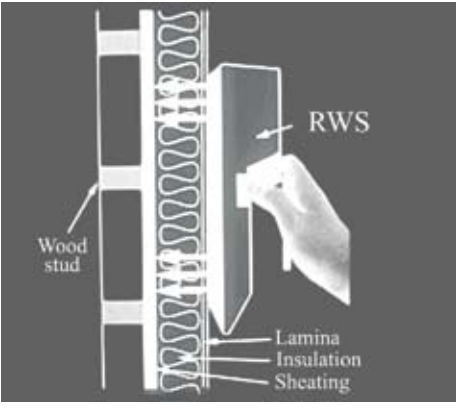


Fig. 2. RWS Low Frequency Signals On EIFS

PRINCIPLES OF OPERATION

To measure / detect moisture, the rubber coated base of the instrument is pressed onto the material being tested. The detection signals from the instrument penetrate the material under test to a depth of up to approximately 75 mm. (3 inches) depending on the mode, the range of sensitivity selected and the material being tested.The small current flowing through the field is inversely proportional to the impedance of the material. This current is a measure of the change in the electrical impedance caused by a change in the moisture content. This change is translated by the RWS and instantly and continuously displayed on the large clear analog dial which gives comparative readings of 0 to 100.

PRIOR TO USE

Although the RWS is checked on manufacture and at quality control to ensure it is in working order before leaving the factory, a few minor checks should be carried out following transit. These are as follows :

Depress ON/OFF switch (located on fascia to the right of grab handle) to power on the RWS. Check battery strength by depressing BATTERY check switch. The needle on the analog dial should go past the BATTERY line on the dial. If not, change the battery. Set the sensitivity dial to 10, place your hand on the base of the instrument, making contact with both electrodes, a full-scale reading of 100 should be obtained, irrespective of which mode or range is selected. See Page 4 for graphic illustration of switches and controls.

Ensure that your new RWS is received in pristine condition, just as it left our factory. Complete and return warranty registration card to Tramex or the supplier of your RWS.

BEFORE CONDUCTING A MOISTURE SURVEY

1. Before commencing moisture testing, it is advisable to familiarise yourself with the RWS, its functions and principles of operation.

2. It is also advisable, prior to commencing your moisture survey, to familiarise yourself with construction details and specification, in particular, type and thickness of insulation, type and thickness of lamina, number of layers of lamina and its reinforcing, coating and covering materials. The composition and specification of the substrate material is also worth knowing. This familiarisation will help you to make the best interpretation of the RWS readings.

3. Check battery strength by pressing down and holding the BATTERY button (Red switch). (The RWS needs to be powered on to check battery strength). The Power On switch is the Black switch located on the right hand side of grab handle. The reading on the analog dial should be above Battery Line (70). If the meter reading is below this, replace the 9 Volt battery (PP3, 1604, 6F22, 6LF22 or equivalent).

4. If meter does not power up, remove the battery cover and check if the battery is connected. If not, connect and ensure that the battery is firmly positioned within the battery retainer.

It is important that the battery is firmly positioned and not free to move, as due to the sensitivity of the RWS an incorrectly positioned or loose battery could affect the readings.

- **EIFS Mode**

For Exterior Insulation and Finishing System (EIFS) and similar types of construction cladding (non-metalic), or foam-over roof insulation systems, the RWS is equipped to detect moisture present in the lamina, insulation or in the substrate behind or under the insulation and assists in tracing leaks back to source..

- **ROOF Mode**

For built up and single ply roofing, the RWS is equipped to detect elevated moisture within the insulation and thickness of the roof, assist in tracing leaks back to source and can also identify areas of inter-ply moisture.

The RWS is designed to read through electrically non-conductive materials that are positioned between the electrodes and the substrate. For example: a conductive layer with metal lath or a wet surface could give false positive readings.

CONDUCTING A MOISTURE SURVEY:

- **EIFS Mode**

Exterior Insulation Finishing System and similar type of building envelope insulation and waterproofing systems.

1. Switch ON the RWS.

2. Select Mode: To select EIFS Mode press MODE switch. When EIFS mode is selected the RED LED will light.

CONDUCTING A MOISTURE SURVEY:

3. Select Signal penetration: press Orange switch to toggle from Low (Yellow LED) to High (Red LED) or vice versa.

LOWER PENETRATION RANGE
(Yellow LED inset in range switch will light) is suitable for use on systems incorporating up to 1" (25mm) thickness of insulation.

HIGHER PENETRATION RANGE
(Red LED inset in range switch will light) is for use on systems with greater than 1" (25mm) thickness of insulation.

4. Hold the RWS by the grab handle and place it so that the rubber electrode is in full and firm contact with the surface over a known dry area. Adjust the sensitivity control knob until the needle is just above zero on the analog meter.

NOTE

On a laboratory mock up on an area where a plywood sheathing substrate had less than 15% moisture content, zero reading corresponded to a setting of 5 on the sensitivity knob of RWS. This was on a 1" expanded polystyrene (EPS) insulation plus lamina over plywood. See Fig 3. (This setting may vary, depending on site conditions, specifications and environmental conditions).

CONDUCTING A MOISTURE SURVEY:

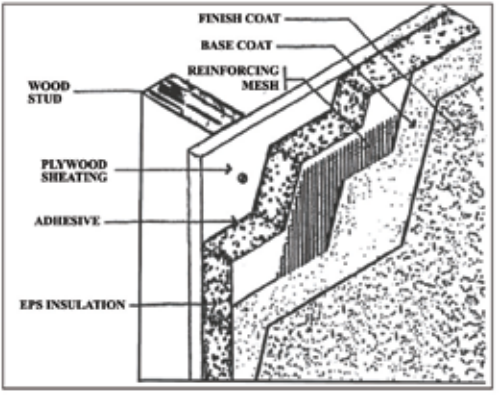


Fig 3. Laboratory Mock-Up

If you are not sure that you are starting over a dry area, a pin-type resistance meter such as the Tramex Professional, with insulated deep wall probes may be useful in confirming an acceptably dry area.

An alternative method is to use the RWS on a seek and find basis as follows: Place the RWS against the surface, adjust the sensitivity control knob so that the meter reads, say 50. Then, by moving from area to area and following in the direction of lowest reading until the area of lowest reading is found (lowest reading should indicate a relative dry area). Over this area, zero the meter reading as described above. You can then double check with a pin-type resistance meter such as the Tramex Professional to confirm a dry area.

CONDUCTING A MOISTURE SURVEY:

Having calibrated (zeroed) on a dry area, now proceed with the moisture survey by moving the RWS across the surface, making sure that electrodes are making full and firm contact with the surface. Partial contact may result in reduced readings. Also ensure that you are holding the RWS firmly by its grab handle as the RWS functions more efficiently when it is hand held while in EIFS mode. If you are setting up a grid pattern for your survey it is important to understand that the RWS is reading the area directly below the footprint of the instrument.

INTERPRETATION OF READINGS

When the RWS has been zeroed correctly on a dry area and set on the correct range for the EIFS thickness, higher readings normally indicate higher moisture content.

Example:

The RWS was calibrated on a laboratory mock-up shown in Table 1. (page 13)

Structural Wood:	4” x 2” Stud
Sheathing:	1/2” Plywood
Insulation:	1”Expanded polystyrene
Lamina:	Glass Fibre Reinforced

INTERPRETATION OF READINGS

Calibration was set on this as follows:

RWS Setting of Sensitivity	RWS Meter Reading	Moisture Content of Sheathing Taken With Meter For Wood % Moisture content (Professional Meter)
5	0	14 %
5	50	20%
5	90-100	28%
5	100+	30%

Table 1. Comparison of RWS and Professional Pin Type Resistance Meter Readings

It should be noted that calibration of the RWS in EIFS MODE was based on the averaged results of numerous on-site and laboratory tests. Therefore readings and results vary depending on construction detail and from site to site. The above chart was the result of tests conducted on a simulated wall construction, as described above and is for guidance purposes only. Readings from the RWS are qualitative, not quantitative, and should be used for comparative purposes only.

INTERPRETATION OF READINGS

As EIFS systems, construction sites, environmental and geographical conditions vary, results and readings will vary also. It is recommended that when carrying out a survey the RWS is zeroed on individual walls and anywhere the operator would expect a change in wall materials, lamina, surface moisture or other conditions that may effect readings.

For example, walls or roofs on ocean-side properties may have higher salt content on the surface and thus slightly higher readings than inland properties, or surface moisture may dry off more slowly depending on orientation of the wall or roofs.

The RWS is designed to have the flexibility in sensitivity adjustment to cope with variances caused by material and conditional differences from wall to wall.

TRACING MOISTURE BACK TO SOURCE IN EIFS OR SIMILAR CONSTRUCTION

Once an area of excess moisture has been established, the RWS may be used to assist in tracing the moisture to the source of ingress as follows:

Having found a wet area, turn down the SENSITIVITY knob until the needle points to approximately half scale (approx 50).

On this setting, take further readings around the area, note the highest reading and follow in the direction of the highest reading. If necessary, decrease sensitivity until the area of greatest moisture has been located.

TRACING MOISTURE BACK TO SOURCE IN EIFS OR SIMILAR CONSTRUCTION

Usually the greatest moisture concentration is in the proximity of the area where the moisture is getting into the system. A careful visual examination in this area should be carried out to identify defects or damage in weatherproofing.

Taking core samples of the EIFS or foamed roof insulation and / or the use of a pin type resistance meter such as a TRAMEX PTM with deep wall probes is recommended to substantiate the RWS readings.

Fig. 4. Professional Pin Meter With Deep Wall Probe.

CONDUCTING A MOISTURE SURVEY:

- **ROOF Mode**

For moisture scanning and leak tracing of Built-Up and Single-Ply Roofing Systems.

Conducting A Roof Survey

1. Switch the RWS ON

2. Select Mode: To select Roof Mode press White MODE switch. When Roof mode is selected the Yellow LED will light.

3. Select Signal penetration: press Orange switch to toggle from Low Range (Yellow LED) to High Range (Red LED) or visa versa.

   LOWER PENETRATION RANGE
   (Yellow LED inset in Orange switch will light) is suitable for use on smooth or mineral surfaced roofs.

   HIGHER PENETRATION RANGE
   (Red LED inset in Orange switch will light) is more sensitive and will read through heavier membranes as well as most dry gravel or ballast roof coverings. (If satisfactory readings cannot be achieved through ballast, remove same and work directly on the surface of the waterproofing material).

CONDUCTING A MOISTURE SURVEY:

- **Procedure**

1. Make a sketch of the roof, indicating openings and protrusions etc.

2. Select a convenient grid span e.g. 6ft (2m). On the North/South perimeter, mark 1,2,3 etc and on the East/West perimeter mark A, B, C etc. Transfer these grid system markings to your roof sketch. See Fig. 5.

3. Proceed by moving the RWS along the imaginary line A and mark locations on the sketch graph paper and / or roof surface when moisture is indicated by the RWS.

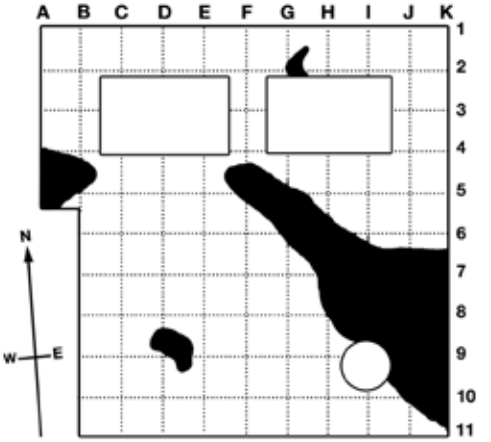


Fig. 5. Roof Grid Sketch

CONDUCTING A MOISTURE SURVEY:

In Fig.5 position A4 is the first point of moisture contact. A telescopic aluminium handle can be attached to the RWS when carrying out a moisture survey on a horizontal surface to avoid having to bend down when taking readings. As the survey continues, a moisture profile will build up, indicating areas which require attention.

4. On single ply roofing, particular attention must be paid to laps and seams.

5. Should a precise moisture percentage be required, a sample can be removed from the site, sealed in a plastic bag and checked in a laboratory, by weighing, drying and re-weighing, to calculate the exact amount of moisture present.

6. It is important also to examine the plies of the waterproofing layers after taking a test cut, as moisture may be present between the plies or within the fibre of the felt.

7. Areas of elevated moisture can be checked with a probe type moisture meter such as the Tramex Professional pin-type meter with deep wall insulated probes.

TRACING A LEAK AND CHECKING SUSPECTED TROUBLE AREAS

If, for instance, a leak has been noticed in a built-up-roof, it may be easy to identify where the water is dripping into the building, but difficult to locate the point of ingress in the waterproof layer. Take your RWS to the general area of the roof over the leak. Switch on to activate the RWS and select the desired range. Turn the sensitivity knob to 10 and place the RWS on the roof surface. (If no reading is received, the insulation directly beneath the instrument is dry). Take point readings around the area until moisture is located.

This identifies where the elevated moisture is located. Mark the roof surface with crayon or paint, outlining the area of wetness. See Fig 6. below.

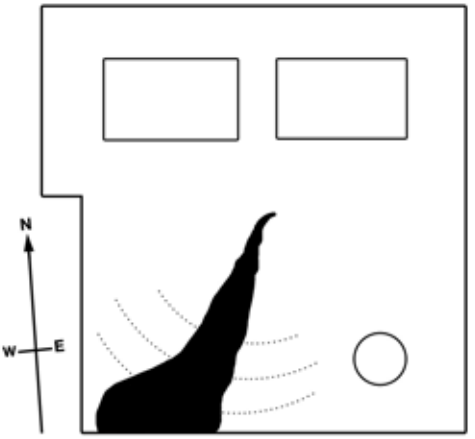


Fig 6. Tracing And Marking A Leak On Your Roof

TRACING A LEAK AND CHECKING SUSPECTED TROUBLE AREAS

To trace the leak back to the source, turn down the sensitivity until the meter needle reads approximately half scale. Take point readings around the area of the leak, following the strongest signal. It may be necessary to reduce the sensitivity a number of times until the area of greatest moisture content is located. Based on the usual pattern of greatest moisture concentration being in proximity to the point at which the moisture gets through into the roof, a visual examination of the area should be carried out to identify defects or damage to the roof covering.

Note: The reading on the RWS. is 'Relative' or 'Comparative', indicating a greater or lesser signal. It is not an indicator of percentage moisture content. As a guide, approximately 20% moisture in wood fibreboard directly under a 3mm (1/8") membrane, will give full-scale deflection in Roof Mode on the Yellow sensitivity range. Many types of insulation currently available can contain up to 200% moisture by weight while others can hold very little mositure. If the precise moisture content is required we recommend a sample core is cut and measured by weigh/dry/weigh method, or by use of a pin type resistance moisture meter. The Tramex Professional pin-type meter can be used to give a better indication of moisture content.

TYPES OF ROOFING STRUCTURES AND THEIR MORE COMMON PROBLEMS

- Built-up Roofing Systems: Comprising of 3 or 4 layers of roofing felt, with bitumen or asphalt adhesive between each layer.

- Modified Bitumen Systems: This type of material is usually heat applied as a single layer system or with a base layer of bituminous felt.

- Single Ply Roofing: Usually applied in welded sheet form, direct to the insulation.

- Note: Using the RWS on black EPDM or Butyl rubber roofing may result in false readings due to the high dielectric constant of this material.

POSSIBLE PROBLEMS LEADING TO MOISTURE INTRUSION OF THE ROOF SYSTEM

- Mechanical damage from maintenance personnel.

- Fissures or cracks in the membrane, caused by building settlement or expansion and contraction.

- Blistering caused by moisture trapped in the roofing system during construction.

- Problems on the laps and up stands if material is not fully sealed during construction.

- Problems usually occur from mechanical damage and maintenance personnel, pinholes, bird damage and faulty seams during construction.

MOISTURE SURVEY CHECKLIST

Recording the following information will assist you in completing a comprehensive moisture survey:

1. Building name and number.
2. Date of survey.
3. Name of surveyor.
4. Visual inspection of all detail work and flashings around doors, windows, openings etc
5. Visual inspection of windows, doors, penetrations, roof lights & openings etc.
6. Visual inspection of vents, chimneys and other protrusions.

USEFUL ITEMS REQUIRED WHEN CONDUCTING A SURVEY

1. Core cutter.
2. Hole punch.
3. Crayon, chalk or spray paint.
4. Tape measure.
5. Spatula, knife and cold mastic, and patching material for minor repairs.
6. Plastic bags for sealing core samples.
7. Pin-type resistance meter with deep wall insulated probes.

CORRECT USE OF RWS

- Make sure that the RWS is held firmly by its built-in plastic grab handle and that your hand is not in contact with the electrode or sides of the instrument. Extension handles, such as telescopic handles, should not be used while in EIFS Mode, as these will affect reading and performance of the RWS, and the handle should not be insulated or isolated from operator's hand when in use. The telescopic extension handle should only be fitted to the RWS for use on roofing in Roof Mode.

- All of the rubber electrodes need to be placed in firm contact with the surface. On narrow areas where full electrode contact is lacking or not possible, it may be necessary to recalibrate the meter.

- On areas where thickness of insulation or lamina varies from that at where the RWS was zeroed, readings may be affected. It may be necessary to compensate for these differences in coatings or insulation specifications.

- At temperatures below 32°F (0°C) the RWS may not function efficiently due to the presence of moisture turning to ice.

- Readings at lower temperatures tend to be lower than those at higher temperatures.

MAINTENANCE OF RWS

- Keep the electrodes clean and dry and regularly inspect for wear.
- Clean electrodes with a damp cloth. Do not use solvents to clean the RWS.
- Remove battery when the RWS is stored for long periods.
- The replacement battery should be of good quality and leak proof.
- The RWS will automatically power off after 30 minutes of inactivity. Avoid leaving the RWS switched on while not in use.
- In the event of a malfunction, return to your supplier. The RWS carries a 12-month warranty. Details and warranty card are supplied with the instrument.

Limitations

The RWS will not detect or measure moisture through any electrically conductive materials including metal sheeting or cladding, black EPDM roofing, butyl roofing, aluminum siding or wet surfaces.

Calibration

Should it be found that readings are outside the set tolerances, it is recommended that the RWS be returned for re-calibration. Calibration adjustments should not be carried out by anyone other than Tramex or their authorised service provider who will issue a calibration certificate on completion. Requirements for quality management and validation procedures, such as ISO 9001, have increased the need for regulation and verification of measuring and test instruments. It is therefore recommended that calibration of the RWS should be checked and certified in accordance with the standards and/or protocols laid down by your industry (usually on an annual basis) by an authorized test provider. The name of your nearest test provider and estimate of cost is available on request.

Warranty

Tramex warrants that this instrument will be free from defects and faulty workmanship for a period of one year from date of first purchase. If a fault develops during the warranty period, Tramex will, at its absolute discretion, either repair the defective product without charge for the parts and labour, or will provide a replacement in exchange for the defective product returned to Tramex Ltd. This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care.

In no event shall Tramex, its agents or distributors be liable to the customer or any other person, company or organisation for any special, indirect, or consequential loss or damage of any type whatsoever (including, without limitation, loss of business, revenue, profits, data, savings or goodwill), whether occasioned by the act, breach, omission, default, or negligence of Tramex Ltd., whether or not foreseeable, arising howsoever out of or in connection with the sale of this product including arising out of breach of contract, tort, misrepresentation or arising from statute or indemnity. Without prejudice to the above, all other warranties, representations and conditions whether made orally or implied by circumstances, custom, contract, equity, statute or common law are hereby excluded, including all terms implied by Section 13, 14 and 15 of the Sale of Goods Act 1893.

Warranty claims

A defective product should be returned shipping pre-paid, with full description of defect to your supplier or to Tramex at address shown on the back of this guide.

Product development

It is the policy of Tramex to continually improve and update all its products. We therefore reserve the right to alter the specification or design of this instrument without prior notice.

Safety

This user guide does not purport to address the safety concerns, if any, associated with this instrument or its use. It is the responsibility of the user of this instrument to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

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